GM	WORLDWIDE ENGINEERING STANDARDS	General Specification Interior	GMW14118

Interior Lighting Technical Specification

1 Introduction

Note: Nothing in this standard supersedes applicable laws and regulations.

Note: In the event of conflict between the English and domestic language, the English language shall take precedence.

This specification defines the requirements for all Interior Lighting Subsystems used in General Motors vehicles. These specifications are in addition to the specifications contained within GMN11012-Global and GMN11039. Any exceptions to specifications contained within this document must be stated in the program specific Appendix C2 SSTS Exceptions document.

1.1 Scope. The requirements contained within this document for the Interior Lighting Subsystem include functions, performance, appearance, design constraints, reliability, and validation. Interior Lighting Subsystems consist of, but are not limited to, reading, overhead courtesy, vanity, glovebox, footwell, ashtray, door entry/exit, floor console compartment, ashtray, trunk, cargo, underhood, and ambient lighting assemblies.

Certain sections or paragraphs are broad in scope as this document must cover many different types of Interior Lighting Subsystems which vary in content, function, location, and design that must satisfy the specific needs of a vehicle program. The Interior Lighting Subsystem shall also comply with the program specific Vehicle Technical Specifications (VTS) when developing the Interior Lighting Subsystem.

In designing the Interior Lighting Subsystem, the Interior Lighting Supplier is expected to work cooperatively with the Interior Center and/or the Responsible Platform(s) and any other component supplier(s) in resolving any interface, design or functional issues. The Interior Lighting Subsystem Leadership Team will be the final arbitrator of any vehicle or subsystem level Interior Lighting requirement. In the case of GMDAT designed components, all interior lighting issues must be addressed by the GMDAT Electrical Council.

1.2 Mission/Theme. The purpose of the Interior Lighting Subsystem is to meet the demands for internal illumination which are generated through vehicle use and the voice of the customer. The Interior Lighting Subsystem will deliver these functions while meeting interface, regulations, standards, and corporate objectives.

1.3 Classification. Not applicable.

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications.

ECE R21	ISO 1629
FMVSS 101	ISO 11469
FMVSS 201	SAE/USCAR-15
FMVSS 302	SAE/USCAR-21
ISO 105-B06	SAE/USCAR-25
ISO 1043	

2.2 GM Standards/Specifications.

GM501M	GMW3103
GM2617M	GMW3116
GM9107P	GMW3191
GM9126P	GMW3208
GME00004	GMW3232
GMI60267	GMW3402
GMN5160	GMW3431
GMN10068	GMW7293
GMN11012	GMW7294
GMN11039	GMW7699
GMN11194	GMW8518
GMW3059	GMW14011
GMW3091	GMW14028
GMW3097	GMW14271
GMW3172	

2.3 Additional References.

- CG1188
- GM1644
- CPE report PG54142, “Los Angeles Area Ozone Data, and its Application to Laboratory Ozone Testing”.
- GM Interior Lighting Best Practices and Lessons Learned.

- Interior Lighting Best Practices located within VPPS v4.0 Interior Lighting 441 Passenger Compartment Lighting and 442 Other Lighting. Refer to Appendix D for a list of SSTS subsystem paragraph requirements.
- SOR Appendix B
- SOR Appendix C3
- SOR Appendix F4
- SOR Appendix F5
- SOR Appendix F10
- SOR Appendix H
- SOR Appendix J
- SOR Appendix J2
- Use of Recycled Materials file on GMSupplyPower

3 Requirements

3.1System/Subsystem/Component/Part Definition. In addition to the requirements defined in the following sections, Interior Lighting Subsystem shall comply with all applicable Interior Lighting Best Practices located within VPPS v4.0 Interior Lighting 441 Passenger Compartment Lighting and 442 Other Lighting. Refer to Appendix D for a list of SSTS subsystem paragraph requirements for specific interior lighting applications.

3.1.1 Appearance. The Interior Lighting Subsystem shall be designed to comply with the following specifications:

3.1.1.1 Part imperfections, manufacturing marks, and unfinished edges shall not be visible with the doors open from outside the vehicle, from any seated position in the vehicle, or while operating the Interior Lighting Subsystem.

3.1.1.2 Only "A" surface and secondary styled surfaces shall be visible to the seated occupants, e.g., bulb holder, bulbs, fasteners, and "B" surface ribs on lens shall not be visible to the seated occupants.

3.1.1.3 Part break-up shall be established such that the resulting gaps are hidden or minimized to the occupant's line of sight.

3.1.1.4 Tolerances for gap, parallelism, and flushness shall be defined in the program specific Dimensional Technical Specification (DTS). The global dimensional technical specification or "0.0" gap and flushness shall be the default when a program specific DTS or requirement does not exist.

3.1.1.5 SOR Appendices B, F4, F5, and F10 program specific appearance specifications.

3.1.2 Content. The Interior Lighting Subsystem shall be designed to the specifications in 3.1.2.1.1 and 3.1.2.1.2

3.1.2.1 Physical Content.

3.1.2.1.1 The Interior Lighting Subsystem shall contain a light source, a lens or light guide, and connector. A reflector, light shield, and lens or light guide optics are optional content.

3.1.2.1.2 The number of lamps, lamp locations, and the lighting theme is specified in SOR Appendix B and the Product Program Content database.

3.1.2.1.3 Light Source. The light source shall be selected from the corresponding region's approved bulb list in which the vehicle is to be sold. For vehicles sold in North America, the light source shall be selected from either the NAO Light Bulb Expert Team Approved Usage List or the GME Approved Bulb List. For vehicles sold in Europe, the light source shall be selected from the GME Approved Bulb List. Light sources may be added to either of these lists if the bulb passes the Pre-production Approval Process specifications.

3.1.2.2 Functional Content: Switches. If a lamp is switchable, the switch shall be independent of the Interior Lighting Subsystem lens. All switches shall comply with Appendix C3 Switch CTS, GMW3172, GMW3431, and GMW3191.

3.1.3 Ambient Environment. Unless otherwise specified, the Interior Lighting Subsystem is to meet the performance requirements specified herein and operate without physical damage or functional degradation when exposed to the ambient and operating environmental conditions defined in the following paragraphs.

3.1.3.1 Engine Compartment Temperature. This paragraph is applicable to underhood lamps only. During the life of the vehicle, the Lighting Subsystem may experience engine compartment ambient temperatures of -40°C to 125°C. The subsystem shall operate but may not meet the illuminance requirements of this specification at the temperature extremes. The Lighting Subsystem shall function and meet all the requirements of this specification with engine compartment ambient temperatures of -20°C to 65°C.

3.1.3.2 Humidity. All non-electrical/non-electronic components of the Interior Lighting Subsystem shall meet the performance requirements when:

3.1.3.2.1 Operated in a condensing atmosphere to maximum temperature of 45°C with a 95% ± 5% relative humidity.

3.1.3.2.2 Stored in a condensing atmosphere to maximum temperature of 65°C with a 95% ± 5%

relative humidity and subsequently operated per the performance specifications contained in this document.

All electrical/electronic Interior Lighting Subsystem components shall meet the specifications defined in the Humidity Test paragraphs in GMW3172.

3.1.3.3 Ozone. This paragraph applies to rubber materials only. The expected ozone operating environment is a maximum (instantaneous value) ozone concentration of 0.40 ppm with an average of 0.029 ppm for 10 years of exposure. Such ozone exposure shall not affect the Interior Lighting Subsystem performance.

CPE report PG54142, "Los Angeles Area Ozone Data, and its Application to Laboratory Ozone Testing".

3.1.3.4 Storage. The Interior Lighting Subsystem shall function and meet all the requirements of this specification after exposure to storage temperatures ranging from -40°C for a 1 week period to 85°C for a 1 week period.

3.1.3.5 Temperature. During the life of the vehicle, the Interior Lighting Subsystem may experience in-the-vehicle ambient temperatures of -40 to 85°C. The Interior Lighting Subsystem shall operate but may not meet the illuminance requirements of this specification at the temperature extremes. The Interior Lighting Subsystem shall function and meet all the requirements of this specification with in-the-vehicle ambient temperatures of -20°C to 65°C.

3.1.3.6 Ambient Room Temperature. Ambient room temperature is defined as 23 ± 5°C.

3.1.3.7 Thermal Shock. The Interior Lighting Subsystem, excluding incandescent bulbs and switches, shall comply with GMW3172 Thermal Shock in Air, operating type 1.2. The Interior Lighting Subsystem shall function between 9 and 16 volts and during and after the part is subjected to thermal shock between temperature extremes of -20 to 65°C. Maximum transition time between exposure to extremes is 1 minute. Minimum dwell time at maximum and minimum temperatures is 60 minutes.

3.1.3.8 Voltage and Current. The Interior Lighting Subsystem shall function within 9.0 to 16.0 Voltage range. LED reading and courtesy lamps without drive modules shall be provided with a PWM signal within a 3.5 to 4.5 Voltage range from the body module.

3.1.3.9 Weather Exposure. Engine compartment mounted subsystem components shall withstand exposure to and subsequently operate as specified in the following paragraphs.

3.1.3.9.1 Dew. The Interior Lighting subsystem shall meet the specifications defined in the Dew Test paragraph in GMW3172.

3.1.3.9.2 Salt Mist. The Lighting Subsystem shall meet the specifications defined in the Corrosion Salt Mist paragraph in GMW3172.

3.1.4 Interfaces. Electrical and interior trim interface requirements apply over the voltage and temperature range of the Interior Lighting Subsystem defined in 3.1.3 subparagraphs. Refer to Interior Lighting Best Practices for detailed interface design criteria.

3.1.4.1 Interfaces within the Interior Lighting Subsystem. All component to component interfaces contained within the Interior Lighting Subsystem, such as the fit between the lamp lens and lamp bezel and the fit between the lamp button and lamp bezel or lens, shall comply with the interior lighting interface Best Practices.

3.1.4.1.1 Lamp Retention. Lamp mounting surfaces shall be designed to allow for the lens of the Interior Lighting Subsystem to withstand a load of 45 N applied normally to the center of the lens without loss of retention from the adjacent Interior Lighting Subsystem component and adjacent Interior Subsystem. For interior lamp assemblies with a switchable lens (push on lens to actuate lamp), the lens of the Interior Lighting Subsystem shall withstand a load of 110 N applied normally to the center of the lens without loss of retention from the adjacent Interior Lighting Subsystem component and adjacent Interior Subsystem.

3.1.4.1.2 Clip Retention. The complete lamp assembly shall be designed to withstand a tensile load of 160 N applied normally to the lamp housing with the lens removed.

3.1.4.1.3 Bulb Retention. Bulbs shall withstand a load of 10 N without loss of retention. Bulb shall not dislodge from vibration inputs incurred during Squeak and Rattle validation testing. The bulb to bulb socket interface shall comply with SAE/USCAR-15, Specification for Testing Automotive Miniature Bulb Socket/Circuit Plate Assemblies.

3.1.4.1.4 Switch Retention If an Interior Lighting Subsystem contains switches, switch operation shall be achieved without perceived deflection of the Interior Lighting Subsystem or adjacent Interior Subsystem. Maximum allowable deflection is 3 mm with a 50 N force and 6 mm with a 100 N force.

3.1.4.1.5 Design to Prevent Light Leaks. The Interior Lighting Subsystems and Interior Lighting Subsystem Components shall be designed to interface with other Interior Subsystems to prevent light leaks visible within the vehicle's interior and

visible while standing outside the vehicle with doors and/or trunk/cargo lids open.

3.1.4.2 Subsystem to Subsystem. The following paragraphs define electrical and interior trim interfaces expected to be incurred between the Interior Lighting Subsystem and the vehicle's Electrical and Interior Trim Subsystems. All performance specifications defined in 3.2 shall be met without damage, defect, or degradation to the Interior Lighting Subsystem and surrounding Electrical and Interior Trim Subsystems.

3.1.4.2.1 Power and Signal Distribution Subsystem (80.2). The Interior Lighting Subsystem shall interface with the vehicle's Power and Signal Distribution Subsystem as follows.

3.1.4.2.1.1 The Power and Signal Distribution Subsystem shall be the source of electrical power for the Interior Lighting Subsystem. It is recognized that electrical power is originated from the Charging and Energy Storage Subsystem. The distinction regarding source, that is made here, permits the Interior Lighting Subsystem to concentrate on delivered power needs while considerations for line losses, shared circuitry, etc. are left to the Power and Signal Distribution Subsystem.

3.1.4.2.1.2 The Interior Lighting Subsystem shall accept Electrically transmitted control signals and data originated by other subsystems via the Power and Signal Distribution Subsystem.

3.1.4.2.1.3 The Power and Signal Distribution Subsystem shall be used for electrical transmicomponents of the Interior Lighting Subsystem.

3.1.4.2.2 Interior Trim Subsystem Interface to Interior Lighting Subsystem Specifications. An interior trim subsystem is defined as one of the following: instrument panel, console, seat, quarter and garnish trim, door trim, roof trim, floor trim, rear compartment trim, and underhood. Interior Lighting Subsystem components are to be packaged on, or in, other Interior Trim Subsystems and both Subsystems shall be designed to meet the following specifications.

3.1.4.2.2.1 The Interior Trim Subsystem shall provide mounting surfaces for the Interior Lighting Subsystem to ensure a fit that shall allow for the lens of the Interior Lighting Subsystem to withstand a normal load of 45 N applied to the center of the lens without loss of retention from the surrounding Interior Lighting Subsystem's trim and without loss of retention from the surrounding Interior Trim Subsystem that contains the Interior Lighting Subsystem.

3.1.4.2.2.2 The Interior Trim Subsystem shall provide an interface to the Interior Lighting Subsystem to ensure that the desired fit between subsystems is executed. The interface between the Interior Lighting Subsystem and the Interior Trim Subsystem shall be designed in a manner that will not allow visible light leaks through any Interior Trim Subsystem. Refer to Interior Best Practices for dimensional specifications that define gap, flush, and crush interface fits.

3.1.4.2.2.3 If necessary, the Interior Trim Subsystem shall provide a trim bezel that may contain other non-interior lighting components in addition to an Interior Lighting Subsystem.

3.1.4.2.2.4 The Interior Trim Subsystem shall allow the Interior Lighting Subsystem to be located in a vehicle position and orientation to meet all Interior Lighting Specifications contained within this document.

3.1.4.2.2.5 The Interior Trim Subsystem shall provide the necessary packaging space and clearance to allow for the execution of the desired interface, to allow the customer to easily interface with the Interior Lighting Subsystem's functional components, and to provide for the appropriate ventilation of the light source contained in the Interior Lighting Subsystem. Detailed design specifications are identified in the Interior Lighting Best practices.

3.1.4.2.2.6 If the Interior Lighting Subsystem contains a switch or functional component, the functional component shall be actuated without perceived deflection of the Interior Lighting Subsystem and without perceived deflection of the adjacent Interior Trim Subsystem that contains the Interior Lighting Subsystem. Subsystem deflections shall not exceed 3 mm with a 50 N applied force and 6 mm with a 100 N applied force.

3.1.4.2.2.7 All interior lighting electrical components, e.g., wiring harnesses and connectors shall not be visible to the customer in any seating position or while standing outside the vehicle with the doors open.

3.1.4.2.2.8 If the Interior Lighting Subsystem door entry/exit lamp is to function as both a courtesy lamp and safety reflector, then the interior lighting feature must also comply with GMNA interior reflex reflector criteria, defined in VTS paragraph 3.2.1.2.3.

3.1.5 Usage Definition. Usage particular to the Interior Lighting Subsystem is defined in the following paragraphs.

3.1.5.1 Subsystem Users. The range of physical dimensions of the user population for which the Interior Lighting Subsystem requirements herein

apply are bounded by the 5th percentile female and the 95th percentile male.

3.1.5.2 Duty Cycle Parameters. The number of expected cycles for Interior Lighting Subsystem elements should be derived from the duty cycle information given in Appendix B.

3.2 Product Characteristics. Product characteristics describe the Interior Lighting Subsystem in terms of performance, physical characteristics, dependability, serviceability, and user-subsystem interface requirements. The subsystem is to satisfy all of the following requirements, under the operating conditions stated in paragraph 3.1 and any additional conditions specified herein.

3.2.1 Performance Requirements.

3.2.1.1 Interior Lighting Subsystem Performance.

3.2.1.1.1 The Interior Lighting Subsystem is designed to:

3.2.1.1.1.1 Meet the occupants' functional interior lighting demands. These demands are generated during the overall use of the vehicle and over a wide range of expected conditions. The subsystem shall perform all specified functions.

3.2.1.1.1.2 Respond to either direct or indirect control input to provide illumination of the vehicle's interior.

3.2.1.1.2 The Interior Lighting Subsystem shall also be designed to meet the following performance specifications.

3.2.1.1.2.1 Light Source and Electronic Components Performance. The light source and electronic components of the Interior Lighting Subsystem shall comply with the following performance specifications.

3.2.1.1.2.1.1 The Color Rendering Index (CRI), the ability of the light source to render colors so they appear normal, shall be above 85 at 2700°K, for incandescent sources.

3.2.1.1.2.1.2 The Color Rendering Index (CRI) for white LEDs shall be at or above 73 at 2700°K.

3.2.1.1.2.1.3 The light source will not be perceived to degrade in both color and intensity during the light source's rated life.

3.2.1.1.2.1.4 Light sources contained within the same Interior Trim Subsystem and performing similar functions shall have the same CRI, the same rated voltage and be within ± 7% of the voltage requirement for lamp application.

3.2.1.1.2.1.5 Any LED module and electronic component used in the Interior Lighting Subsystem shall have a parasitic current value of zero (0) in the off state.

3.2.1.2 Interior Illumination Performance. The Interior Lighting Subsystems shall be designed to the following.

3.2.1.2.1 Courtesy Lighting. Courtesy lighting provides general illumination in or around the vehicle when an unlocked or open door signal is transmitted into the vehicle. Courtesy lighting provides illumination to assist in entry/egress and locating objects within the vehicle. Courtesy lighting requirements are specified in the following paragraphs and apply only to lamps that have a dedicated function of illuminating a single target area. Refer to Appendix C for lamp target area diagrams with measurement locations.

3.2.1.2.1.1 Overhead Courtesy Lighting Overhead courtesy lighting provides general illumination to the vehicle's interior. Courtesy lighting requirements are specified in the following paragraphs.

3.2.1.2.1.1.1 Location and Illuminance. The courtesy lamp shall be designed to the following:

3.2.1.2.1.1.1.1 The courtesy lamp shall flood the seat cushion areas and illuminate an area from the instrument panel to the top of the rear seat and from side door to side door.

3.2.1.2.1.1.1.2 Illuminance at a 12.5 ± 0.1 V at each seat cushion is measured at 5 locations, the center and the 4 corners of a 300 mm x 300 mm square centered on the seat cushion. The average of the 5 measurements shall be ≥10 Lux with a 7 Lux minimum at an individual point.

3.2.1.2.1.1.2 Uniformity. Courtesy lamp illuminance uniformity shall not vary beyond a 2/1 max/minimum ratio within the target area.

3.2.1.2.1.2 Footwell Lighting. Footwell lighting provides general illumination to the front and rear footwell areas. Footwell lighting should illuminate the entire footwell including under the driver's foot pedals. Footwell lighting requirements are specified in the following paragraphs.

3.2.1.2.1.2.1 Location and Illuminance. The footwell lamp shall be designed to the following.

3.2.1.2.1.2.1.1 The footwell lamp shall be focused on the center of the foot well area.

3.2.1.2.1.2.1.2 Illuminance at a 12.5 ± 0.1 V at each footwell is measured at 5 locations, the center and the four 4 corners of a 400 mm x 400 mm square centered in the footwell for front row seats. Use a 250 mm (fore/aft) x 400 mm rectangle for all other rows. If the footwell area is smaller than the target area, then the maximum length and width of the footwell area shall be used

as the target area. The average of the 5 measurements shall be ≥5 Lux. It is expected that LED footwell lighting will function as ambient lighting. For LED footwell lighting, the average of the 5 measurements shall be ≥0.5 Lux.

3.2.1.2.1.2.2 Uniformity. Footwell lamp illuminance uniformity shall not vary beyond a 3/1 max/min ratio within the target area.

3.2.1.2.1.3 Door Entry/Exit Lighting. Door entry/exit lighting provides general illumination to the front and rear door opening areas. Door entry/exit lighting requirements are specified in the following paragraphs.

3.2.1.2.1.3.1 Location and Illuminance. The door entry/exit lamp shall be designed to the following:

3.2.1.2.1.3.1.1 The door entry/exit lamp shall be focused on the ground between the door, in its maximum open position, and the vehicle's body at the door opening.

3.2.1.2.1.3.1.2 Illuminance at a 12.5 ± 0.1 V at each door opening is measured at 5 locations, the center, 3 corners, and center of arc length of the target area. The target area is defined as the arc area created when the door trim line is offset 100 mm with the door in the full-open position, the outboard rocker panel line is offset 100 mm, and the arc created as the door swings from the closed to the full-open position. The 5 measurement locations are defined as follows: points two (2), three (3), and four (4) are located at the corners of the target area, point five (5) is located as the midpoint of the arc length between points two (2) and four (4), and point one (1) is located at the midpoint between points three (3) and five (5). If the vehicle is available as a coupe and sedan, the target area is created from the smaller sedan door for both vehicle types. If the vehicle is only available as a coupe, the target area's fore/aft length between points two (2) and three (3) is 800 mm. The front corner is even with the front edge of the trim and the side along the door should be within 100 mm of the door trim surface in the plan view. The average of the 5 measurements shall be ≥5 Lux. Any target point that is shadowed by the vehicle will not be included in the average Lux calculation.

3.2.1.2.1.3.2 Uniformity. Door entry/exit lamp illuminance uniformity shall not vary beyond a 5/1 max/min ratio within the target area.

3.2.1.2.2 Task Lighting. Task lighting provides illumination in a storage compartment or provides focused illumination to a specific interior vehicle area to assist occupants in completing an interior vehicle task. Interior Lighting Subsystems grouped within this category have occupant actuated switching controls or indirectly switched controls actuated by opening a compartment. Illuminance requirements for task lamps are defined at a Voltage level of 13.5 ± 0.1 V.

3.2.1.2.2.1 Reading Lamps. Reading lamps provide focused illumination enabling vehicle occupants to read maps, books, or other reading materials. These lamps are occupant selectable via a local switching device. Reading lamp requirements are specified in the following paragraphs.

3.2.1.2.2.1.1 Location and Illuminance. Illuminance is measured at 21 total points on the target area. Points One (1) through 13 defined the reading lamp focused light target area. Points 14 through 21 define the reading lamp stray light target area. Prior to locating the reading lamp target areas, seats should be in nominal design position. Front seats should be moved forward to prevent shadowing on the rear reading lamp target areas. The reading lamps shall be designed to the following:

3.2.1.2.2.1.1.1 The reading lamp's focused light is measured at 13.5 ± 0.1 V on a circular target area that is 300 mm in diameter and oriented at a 35 degree angle from the horizontal. The center of the circular target is located 350 mm forward and 350 mm above the Seating Reference Point, SgRP (or H point). If the lamp to be used is carryover from another vehicle program, the reading light circle can be located ± 100 mm from the center of the 500 mm stray light target defined in the following subparagraph. The average of points one (1) through 13 shall be 55 Lux minimum, and 75 Lux maximum.

3.2.1.2.2.1.1.2 The reading lamp's stray light is measured on a circular target area that is 500 mm in diameter and oriented at a 35 degree angle from the horizontal. The center of the circular target area is located 350 mm forward and 350 mm above the SgRP (H Point). The average of points 14 through 21 shall be 25 Lux maximum.

3.2.1.2.2.1.1.3 No stray light from the reading lamp shall exceed 10 Lux on any horizontal surface of the Instrument Panel.

3.2.1.2.2.1.1.4 If a reading lamp is to also function to provide courtesy illumination and the vehicle does not have a dedicated courtesy lamp, then the reading lamps shall be designed to meet the reading lamp performance specifications and shall have a courtesy lamp average illuminance of 8 Lux. A combined reading and courtesy lamp execution is not recommended. Optimum illumination is obtained when both lamps function

independently within a common lamp assembly or in separate lamp assemblies.

3.2.1.2.2.1.2 Uniformity. Reading lamp illuminance uniformity shall not vary beyond a 3/1 max/minimum ratio within the target area.

3.2.1.2.2.2 Vanity Lighting. Vanity lighting provides soft uniform illumination towards an occupant's face when looking at the vanity. Vanity lighting requirements are specified in the following paragraphs.

3.2.1.2.2.2.1 Location and Illuminance. The vanity lighting shall be designed to the following:

3.2.1.2.2.2.1.1 Illuminance at a 13.5 ± 0.1 V for each vanity is measured at 5 locations on a 250 mm circular target area that is oriented parallel to a vertically positioned mirror at a perpendicular distance of 300 mm from the mirror and with the mirror and target area centers aligned along the z axis. The five (5) points are located at the center and the three (3), six (6), nine (9), and Twelve (12) o'clock positions along the perimeter of the circular target. Illuminance at each point shall be between 10 and 40 Lux. The average illuminance of the five (5) points shall be between 15 and 35 Lux. For lit vanities with adjustable intensity levels, an illuminance of 15 Lux shall fall within the adjustable intensity range.

3.2.1.2.2.2.2 Uniformity Vanity lamp illuminance uniformity shall not vary beyond a 2/1 max/minimum ratio within the target area.

3.2.1.2.2.3 Storage Compartment Lighting. Storage compartment lighting provides focused illumination to assist vehicle occupants in storing items. Storage compartment lighting requirements are specified in the following paragraphs.

3.2.1.2.2.3.1 Location and Illuminance. The storage compartment lighting shall be designed to the following:

3.2.1.2.2.3.1.1 Storage compartment lighting should flood the storage compartment including all corners of the bin. The compartment lamp should be located to maximize the spread of light within the compartment.

3.2.1.2.2.3.1.2 Illuminance at a 12.5 ± 0.1 V is measured at 5 locations, the center and four (4) corners on the bin's floor of a stationary bin design or the inside center and four (4) corners of a rotating bin design. If the floor is irregular shaped, the measurement is taken at the center of the largest primary usable floor surface. Glove box illumination measurements are to be taken with the owner's manual in the intended stowed position. The average of the five (5) measurements shall be ≥25 Lux with a 5 Lux minimum at an individual point.

3.2.1.2.2.3.2 Uniformity. Storage compartment illuminance uniformity shall not vary beyond a ¼ max/minimum ratio within the target area.

3.2.1.2.2.4 Trunk Lighting. Trunk lighting provides illumination to the trunk compartment. The trunk lighting requirements are specified in the following paragraphs.

3.2.1.2.2.4.1 Location and Illuminance. The trunk lighting shall be designed to the following:

3.2.1.2.2.4.1.1 Trunk lighting should illuminate the entire trunk floor.

3.2.1.2.2.4.1.2 The preferred lamp location is the underside of the package shelf within ± 150 mm cross car of the vehicle centerline and within ± 200 mm fore/aft of the center of the trunk.

3.2.1.2.2.4.1.3 The trunk lighting target area is defined using two rectangles. Rectangle one (1) is the maximum sized best fit rectangle within the trunk load floor. Rectangle two (2) shares the same center point as Rectangle one (1) and is created by a 150 mm inboard offset from Rectangle one (1). Illuminance at a 12.5 ± 0.1 V is measured at 5 locations, the center and the four (4) corners of Rectangle two (2). The average of the 5 measurements shall be ≥20 Lux with a 10 Lux minimum at each point. If storage compartments are provided in the trunk area, the intensity at the center of the compartment's floor shall be 5 Lux minimum.

3.2.1.2.2.4.2 Uniformity. Trunk lighting illuminance uniformity shall not vary beyond a 4/1 max/minimum ratio within the target area.

3.2.1.2.2.5 Cargo Lighting. Cargo lighting provides illumination to the rear compartment of the vehicle. It is not expected that a single light source will fulfill the performance requirements for both the cargo and rear puddle lighting. The cargo lighting requirements are specified in the following paragraphs.

3.2.1.2.2.5.1 Cargo Lighting Location and Illuminance. The cargo lighting shall be designed to the following:

3.2.1.2.2.5.1.1 Cargo lighting shall illuminate the entire cargo floor. Rear seat position must be considered when positioning the cargo lamp.

3.2.1.2.2.5.1.2 The cargo lighting target area is defined using two (2) rectangles. Rectangle one (1) is the maximum sized best fit rectangle within the cargo load floor. Rectangle two (2) shares the same center point as Rectangle one (1) and is created by a 150 mm inboard offset from Rectangle one (1). Illuminance at a 12.5 ± 0.1 V is measured at 5 locations, the

center and the four (4) corners of Rectangle two (2). The average of the 5 measurements shall be ≥10 Lux with a 5 Lux minimum at each point. With the spare tire cover removed, the intensity at the center top surface of the spare tire and/or recessed compartment floor shall be 10 Lux minimum. If storage compartments are provided in the cargo area, the intensity at the center of the compartment floor shall be 5 Lux minimum.

3.2.1.2.2.5.2 Uniformity. The cargo lighting illuminance uniformity shall not vary beyond a 4/1 max/minimum ratio within the target area.

3.2.1.2.2.6 Rear Puddle Lighting. Rear puddle lighting illuminates the ground rearward of the vehicle. It is not expected that a single light source will fulfill the performance requirements for both the cargo and rear puddle lighting. The rear puddle lighting requirements are specified in the following paragraphs.

3.2.1.2.2.6.1 Rear Puddle Lighting Location and Illuminance. The rear puddle lighting shall be designed to the following:

Rear puddle lighting is measured using an oval target area with a center fore/aft length of 400 mm and a width equal to the interior cargo rear opening. The target area is placed on the ground along the rearward edge of the bumper. If the bumper shadows the target area the target area can be moved 0 to 150 mm rearward of the most rearward portion of the bumper. Illuminance is measured at 5 locations on the target area, the center and the four (4) most outboard and fore/aft locations on the perimeter of the oval from the center point. The illuminance at a 12.5 ± 0.1 V at each point shall be ≥1 Lux with an average illuminance of 2°Lux.

3.2.1.2.2.6.2 Uniformity. The rear puddle lighting illuminance uniformity shall not vary beyond a 10/1 max/minimum ratio within the target area.

3.2.1.2.2.7 Underhood Lighting. Underhood lighting illuminates the engine compartment components to allow for viewing of owner maintained service items. Underhood lighting requirements are specified in the following paragraphs.

3.2.1.2.2.7.1 Location and Illuminance. Underhood lighting location and illuminance requirements are:

3.2.1.2.2.7.1.1 The underhood lamp shall flood light onto the engine compartment elements that the owner may need to inspect or service. The Lighting Subsystem shall be located to optimally illuminate the following areas: the battery terminals, oil dipstick cover, and washer fluid fill cap.

3.2.1.2.2.7.1.1 Illuminance at a 12.5 ± 0.1 V is measured at the center of the battery terminals, oil dipstick cover, and washer fluid fill cap. The illuminance requirement at each location is ≥3 Lux.

3.2.1.2.3 Ambient Lighting. Ambient lighting is to illuminate vehicle interior features at a low illuminance level that is not distracting to the driver. Illuminance defined in paragraphs 3.2.1.2.3.2.3 to 3.2.1.2.3.2.5 may be narrowed to obtain the desired vehicle specific illumination results. Design of the ambient Interior Lighting Subsystem shall be established by assessing the location of the light source, color of the light source, size of the target area, and characteristics of the interior trim materials within the target areas.

3.2.1.2.3.1 The ambient Interior Lighting Subsystem shall comply with FMVSS 101.

Note: It is recommended that the light source be dimmable and active with the exterior park and head lamps.

3.2.1.2.3.2 Location and Illuminance. Ambient lighting location and illuminance requirements are:

3.2.1.2.3.2.1 Light from the source should be contained within the target area with minimal stray light outside of the target area.

3.2.1.2.3.2.2 Compliance of adequate intensity and area illuminated will be judged during the TALC and Interior Lighting Review. Illuminance measurements are to be taken at 13.5 ± 0.1 V at the full-brightness level if the feature is dimmable.

3.2.1.2.3.2.3 Floor console Illuminance. Illuminance on the target area shall be 1.0 ± 0.75 Lux.

3.2.1.2.3.2.4 Door Handle Illuminance. Illuminance is measured at the top center surface of the handle. Illuminance at the measurement point shall be 0.50 ± 0.30 Lux.

3.2.1.2.3.2.5 Door Trim Accent Illuminance. Illuminance at the target area shall be 0.50 ± 0.30 Lux.

3.2.1.2.3.2.6 Footwell Illuminance. The target area is defined in the Footwell Lighting Location and Illuminance paragraph. Illuminance on the target area shall average 1.5 ± 0.5 Lux.

3.2.1.2.3.2.7 Storage Bin Illuminance. The target area is defined in the Storage Compartment Lighting Location and Illuminance paragraph. Illuminance on the target area shall average 0.50 ± 0.30 Lux.

3.2.1.2.3.3 Uniformity. The ambient Interior Lighting Subsystem shall comply with the following:

3.2.1.2.3.3.1 Uniformly illuminate the target area.

3.2.1.2.3.3.2 Differences in illumination between the front, rear, left hand side, and right hand side ambient Interior Lighting Subsystems shall not be discernable.

3.2.1.2.4 General Uniformity Requirement. In additional to the uniformity requirements defined for each Interior Lighting Subsystem the Subsystem shall be designed to the following:

3.2.1.2.4.1 The Interior Lighting Subsystem shall not create observable light patterns on the target areas.

3.2.1.2.4.2 The Interior Lighting Subsystem shall not create observable color patterns on the target areas.

3.2.1.3 Glare Control. Distracting glare can be caused by any unintentional luminance from any Interior Lighting Subsystem or surfaces in the vehicle that are visible in the driver's approximate eye ellipse centroid. The driver should not have a direct line of sight to the light source nor see the light source in the inside rearview mirror. Refer to the Glare Control Best Practice for design guidance to prevent distracting glare. Final compliance will be judged at IVER validation by the program specific Interior Trim Validation Engineer.

3.2.1.4 Reflections. The Interior Lighting Subsystem shall not produce reflections onto any adjacent A-surface Interior Trim.

3.2.1.5 Contour Plots. A contour plot or other equivalent software output shall be used to demonstrate compliance of performance specifications during vehicle development prior to physical components. The Interior Lighting Test Procedure GMW14271 provides content and format expectations for contour plots and software results.

3.2.1.6 Continuous On. The Interior Lighting Subsystem shall not show loss of function or visible loss of material integrity (distortion or discoloration) after 4 h of continuous on at 50°C (dead air) with the Interior Lighting Subsystem powered to 13 Volts and for all possible light source configurations of the Interior Lighting Subsystem.

3.2.1.7 Heat. The requirements on the heat generated/emitted by operation of Interior Lighting components when operated at design voltage at room ambient temperature.

3.2.1.7.1 The surface temperature for any exposed component of the Interior Lighting shall not exceed 60°C for plastics and 45°C for metals.

3.2.1.7.2 The surface temperature for any lens used as a switch shall not exceed 49°C.

3.2.1.7.3 Temperature rise for any adjoining or adjacent component of another subsystem as a result of an Interior Lighting component's heat transmission shall not exceed 45°C.

3.2.1.8 Squeak and Rattle The following paragraphs define squeak and rattle requirements for the Interior Lighting Subsystem and its interface to other vehicle Subsystems.

3.2.1.8.1 Component and Subsystem Level. The vibration input frequencies and amplitudes will be determined based on the location of the Interior Lighting Subsystem in the vehicle and region where the Interior Lighting Subsystem is designed. The Interior Lighting Subsystem shall comply with subparagraphs a. or b. For GM regions that have not been assigned to a subparagraph, the Interior Lighting Subsystem shall comply with subparagraph a. Objective Test Requirements.

3.2.1.8.1.1 GMNA. Objective Test Requirements (for GMNA and Regions with Objective Testing Capability): All configurations of the Interior Lighting Subsystem shall have an instationary Zwicker loudness of less than or equal to 4.0 sones N10 (90^{th} percentile) when evaluated in the vertical, fore/aft, and lateral directions according to test procedure GMW14011TP, Objective Subsystem/Component Squeak and Rattle Test, using the vibration input frequencies and amplitudes defined in Appendix A tables.

3.2.1.8.1.2 GME, GMLAAM, GMDAT. Subjective Test Requirements: Use the vibration input frequencies and amplitudes defined in Appendix A tables. The subjective rating of the squeak and rattle performance of the Interior Lighting Subsystem contains the following elements:

3.2.1.8.1.2.1 Rate squeak and rattle performance of the subsystem/component in all configurations and conditions according to GMW7293TP

3.2.1.8.1.2.2 Rate squeak and rattle performance during adjusting/operating subsystem/component according to GMW8518

3.2.1.8.1.2.3 Rate squeak and rattle performance during hand impacts, hand flexures, and passenger motion where the customer would normally interface with the subsystem/component, and in a manner consistent with expected average customer behavior. The minimum subjective rating under all conditions for any individual compliant and the overall rating for the subsystem determined according to GMW7294 is 8.0.

3.2.1.8.2 Squeak and Rattle Degradation. The Interior Lighting Subsystem shall reach the above requirements (4.0 sones/rating 8.0) also after degradation according to procedure GMN5160TP. Reference vibration tables.

3.2.1.8.3 Subsystem in the Integration Environment (Interfaces). Additional to the laboratory tests, the following requirements shall be fulfilled when the Interior Lighting Subsystem is installed in a vehicle and tests are performed according to GMW8518, GMW7699, and Global Customer Audit and shall result in no design-related squeak and rattle defects below rating 8.0 and a minimum overall rating for the subsystem determined according to GMW7294 is 8.0.

3.2.1.9 Plastics. The Interior Lighting Subsystem shall comply with one of the region specific subparagraphs 3.2.1.9.1 or 3.2.1.9.2.

3.2.1.9.1 GME, SGM, GMDAT. Plastic interior parts must comply with requirements in GME00004.

3.2.1.9.2 GMNA. Plastic interior parts must comply with requirements in GM2617M.

3.2.1.10 Altitude. All Interior Lighting Subsystem electrical/electronic components shall comply with the Altitude Tests specified of GMW3172.

3.2.1.11 Color Fastness of Light. The Interior Lighting Subsystem shall be tested to meet ISO 105-B06 for three (3) cycles and obtain a rating of 3 minimum/less stained light withdraw permissible.

3.2.1.12 Drop. The Interior Lighting Subsystem shall meet the specifications defined in the Free Fall (Drop Test) paragraph of GMW3172. The Interior Lighting Subsystem shall also have an impact strength tested to GMI60267 at -30°C, 2.5 J minimum, and a ball of 50 mm.

3.2.1.13 Electromagnetic Compatibility (EMC). The Interior Lighting Subsystem shall follow the Global EMC Component/Subsystem Validation Acceptance Process defined in GMW3103, GMW3091, and GMW3097 for all EMC component design, development and validation. The Interior Lighting component/subsystem shall pass both the component/subsystem level electromagnetic compatibility test(s) and the vehicle level EMC test(s). In the event that a component/subsystem passes the component/subsystem level EMC test, the vehicle level test results shall be the determining factor for validation test pass/fail status.

3.2.1.14 Power Temperature Cycle. The Interior Lighting Subsystem shall meet the specifications defined in Power Temperature Cycle Test paragraph in GMW3172.

3.2.1.15 Resistance to Chemicals. The Interior Lighting Subsystem shall comply with resistance to chemical specifications defined in GMW3402 with a minimum rating of 6.

3.2.1.16 Dust. The Interior Lighting Subsystem electrical/electronic components shall be tested to meet the Dust Test paragraphs in GMW3172. Non-electrical components shall be tested to GMW3208/A/5 for 300 cycles with a rating of 6 minimum.

3.2.1.17 Thermal Shock in Water. This paragraph is only applicable to Lighting Subsystems located in the following areas: Underhood/Engine Compartment, door mounted lamps located outside the door sill, and sill plate mounted lamps located outside the door sill. The Lighting Subsystem shall meet the specifications defined in the Thermal Shock/Water Splash paragraph in GMW3172.

3.2.1.18 Flammability The Interior Lighting Subsystem shall comply with flammability requirements defined in GMW3232 and FMVSS 302.

3.2.2 Physical Characteristics. Subparagraphs of 3.2.2 define the physical characteristics that the Interior Lighting Subsystem must have to ensure physical compatibility with other subsystems and components when integrated into the vehicle.

3.2.3 Dependability. Dependability is the ability of the Interior Lighting subsystem to function during a specified time within the performance levels specified in this SSTS. The dependability requirements for the Interior Lighting system are specified in the following paragraphs.

3.2.3.1 Reliability Evalution Points (REP). The Reliability Evaluation Point is 160 900 km (100 000 mi) or 10 years which ever comes first. Compliance with these durability requirements will be evaluated using severe levels of customer usage through 160 900 km (100 000 mi) plus10 years of severe environmental exposure.

Appendix B lists the number of test cycles and on-time that are equivalent to the REP in testing for each type of lighting system. This is also known as “one customer usage”.

3.2.3.2 Class One (1)- and Two (2)- Type Problems. The subsystem shall have no Class One (1) - Type or Class two (2) - Type Problems that have not been addressed at the start of production of saleable vehicles. Class one (1) and two (2) Type Problems are problems which occur within the vehicle's one customer usage and target market area, and which result in any of the following:

3.2.3.2.1 Class One (1)-Type

3.2.3.2.1.1 Non-compliance with any applicable governmental regulation.

3.2.3.2.1.2 Loss of function leading to major injury to any person (such as vehicle occupants, pedestrians, or service personnel) and/or major vehicle damage.

3.2.3.2.1.3 Loss of function such that the vehicle is disabled and requires repair at a dealership or other repair facility before it can be driven again (*for example, "walk-homes" which cannot be addressed at the problem occurrence site via a typical roadside assistance vehicle).*

3.2.3.2.2 Class Two (2)- Type

3.2.3.2.2.1 Vehicle function severely degraded, requiring immediate service at a dealership or other repair facility.

3.2.3.3 Test Reliability Requirements. Each Interior Lighting component, i.e., Courtesy light, Entry/Exit Light, Footwell Light, Trunk/Cargo Light, Underhood Light Ambient Light, etc., shall demonstrate a test reliability of R98 C50 at one (1) customer usage as defined in Appendix B.

3.2.3.4 Durability. The Interior Lighting Subsystem, as installed in the vehicle, shall meet the specified performance requirements for 10 years or 160 900 km (100 000 mi), while exposed to the environmental and usage conditions specified in this document.

3.2.3.4.1 Durability Test. For each type of motion, test 6 parts to failure up to a maximum of 3 times life to the cycling temperature profile. The reliability shall be 97.8% or greater at 50% confidence for one severe customer usage with an assumed Weibull slope of 1.5. Prior to cycling, samples should undergo the following pre-treatments: Humidity (See 3.1.3.2), Thermal Shock (3.1.3.7), Frost, Shock, and Vibration. Performance specifications defined in 3.2.1.1.2 through 3.2.1.1.4 do not have to be met following completion of cycle testing. All components of the lamp assemblies shall be functional upon completion of the cycle testing.

3.2.3.4.1.1 Overhead Courtesy Light. Before cycling, measure efforts.

Table 1: Overhead Courtesy Light Operational Cycle Temperature Profile

Cycles	Temperature
Run 7 000 cycles	23 ± 5°C
Run 1 000 cycles	85 ± 5°C
Run 1 000 cycles	-30 ± 5°C
Run 1 000 cycles	40 ± 5°C and 95% relative humidity

Note: Cycle at a maximum of 10 cycles per minute. Measure efforts after each life. Repeat profile.

3.2.3.4.1.2 Glovebox Light (with built-in switch). Before cycling, measure efforts.

Table 2: Glovebox Operational Cycle Temperature Profile

Cycles	Temperature
Light Run 7 000 cycles	23 ± 5°C
Run 1 000 cycles	85 ± 5°C
Run 1 000 cycles	-30 ± 5°C
Run 1 000 cycles	40 ± 5°C and 95% relative humidity

Note: Cycle at a maximum of 10 cycles per minute. Measure efforts after each life. Repeat profile.

3.2.3.4.1.3 Reading Light. Operational cycle temperature profile. Before cycling, measure efforts.

Table 3: Reading Light. Operational Cycle temperature profile:

Cycles	Temperature
Run 7 000 cycles	23 ± 5°C
Run 1 000 cycles	85 ± 5°C
Run 1 000 cycles	-30 ± 5°C
Run 1 000 cycles	40 ± 5°C and 95% relative humidity

Note: Cycle at a maximum of 10 cycles per minute. Measure efforts after each life. Repeat profile.

3.2.3.4.1.4 Vanity Light.

3.2.3.4.1.4.1 Single Intensity Vanity Light with Auto Shut-off Switch. Operational cycle temperature profile for both the lamp and switch. Before cycling, measure efforts.

Table 4: Single Intensity Vanity Light Operational Cycle Temperature Profile

Cycles	Temperature
Run 2 940 cycles	23 ± 5°C
Run 420 cycles	85 ± 5°C
Run 420 cycles	-30 ± 5°C
Run 420 cycles	40 ± 5°C and 95% relative humidity

Note: Cycle at a maximum of 10 cycles per minute. Measure efforts after each life. Repeat profile.

3.2.3.4.1.4.2 Variable Intensity Vanity Light with Auto Shut-off Switch. Operational cycle temperature profile for both the lamp and switch. Before cycling, measure efforts.

Table 5: Variable Intensity Vanity Light Operational Cycle Temperature Profile

Cycles	Temperature
Run 2 940 cycles	23 ± 5°C
Run 350 cycles	85 ± 5°C
Run 350 cycles	-30 ± 5°C
Run 350 cycles	40 ± 5°C and 95% relative humidity

Note: Cycle at a maximum of 10 cycles per minute. Measure efforts after each life. Repeat profile.

3.2.3.4.1.5 Footwell Light. Operational cycle temperature profile. Before cycling, measure efforts.

Table 6: Footwell Light Operational Cycle Temperature Profile

Cycles	Temperature
Run 7 000 cycles	23 ± 5°C
Run 1 000 cycles	85 ± 5°C
Run 1 000 cycles	-30 ± 5°C
Run 1 000 cycles	40 ± 5°C and 95% relative humidity

Note: Cycle at a maximum of 10 cycles per minute. Measure efforts after each life. Repeat profile.

3.2.3.4.1.6 Ashtray Light. Operational cycle temperature profile. Before cycling, measure efforts.

Table 7: Ashtray Light Operational Cycle Temperature Profile

Cycles	Temperature
Run 7 000 cycles	23 ± 5°C
Run 1 000 cycles	85 ± 5°C
Run 1 000 cycles	-30 ± 5°C
Run 1 000 cycles	40 ± 5°C and 95% relative humidity

Note: Cycle at a maximum of 10 cycles per minute. Measure efforts after each life. Repeat profile.

3.2.3.4.1.7 Door Entry/Exit Light. Operational cycle temperature profile. Before cycling, measure efforts.

Table 8: Door Entry/Exit Light Operational Cycle Temperature Profile

Cycles	Temperature
Run 70 000 cycles	23 ± 5°C
Run 10 000 cycles	85 ± 5°C
Run 10 000 cycles	-30 ± 5°C
Run 10 000 cycles	40 ± 5°C and 95% relative humidity

Note: Cycle at a maximum of 10 cycles per minute. Measure efforts after each life. Repeat profile.

3.2.3.4.1.8 Floor Console Light. Operational cycle temperature profile. Before cycling, measure efforts.

Table 9: Floor Console Light Operational Cycle Temperature Profile

Cycles	Temperature
Run 7 000 cycles	23 ± 5°C
Run 1 000 cycles	85 ± 5°C
Run 1 000 cycles	-30 ± 5°C
Run 1 000 cycles	40 ± 5°C and 95% relative humidity

Note: Cycle at a maximum of 10 cycles per minute. Measure efforts after each life. Repeat profile.

3.2.3.4.1.9 Ambient Light. Operational cycle temperature profile. Before cycling, measure efforts.

Table 10: Ambient Light Operational Cycle Temperature Profile

Cycles	Temperature
Run 14 000 cycles	23 ± 5°C
Run 2 000 cycles	85 ± 5°C
Run 2 000 cycles	-30 ± 5°C
Run 2 000 cycles	40 ± 5°C and 95% relative humidity

Note: Cycle at a maximum of 10 cycles per minute. Measure efforts after each life. Repeat profile.

3.2.3.4.1.10 Underhood Light. Operational cycle temperature profile. Before cycling, measure efforts.

Table 11: Underhood Light Operational Cycle Temperature Profile

Cycles	Temperature
Run 700 cycles	23 ± 5°C
Run 100 cycles	85 ± 5°C
Run 100 cycles	-30 ± 5°C
Run 100 cycles	40 ± 5°C and 95% relative humidity

Note: Cycle at a maximum of 10 cycles per minute. Measure efforts after each life. Repeat profile.

3.2.3.4.1.11 Trunk/Cargo Light.

3.2.3.4.1.11.1 Trunk Lid Mounted. Operational cycle temperature profile. Before cycling, measure efforts.

Table 12: Trunk Lid Mounted Operational Cycle Temperature Profile.

Cycles	Temperature
Run 21 000 cycles	23 ± 5°C
Run 3 000 cycles	85 ± 5°C
Run 3 000 cycles	-30 ± 5°C
Run 3 000 cycles	40 ± 5°C and 95% relative humidity

Note: Cycle at a maximum of 10 cycles per minute. Measure efforts after each life. Repeat profile.

3.2.3.4.1.11.2 Hatch/Liftgate and Tailgate Mounted. Operational cycle temperature profile. Before cycling, measure efforts.

Table 13: Hatch/Liftgate and Tailgate Mounted Operational Cycle Temperature Profile.

Cycles	Temperature
Run 35 000 cycles	23 ± 5°C
Run 5 000 cycles	85 ± 5°C
Run 5 000 cycles	-30 ± 5°C
Run 5 000 cycles	40 ± 5°C and 95% relative humidity

Note: Cycle at a maximum of 10 cycles per minute. Measure efforts after each life. Repeat profile.

3.2.3.4.1.12 Garnish Mounted. Operational cycle temperature profile. Before cycling, measure efforts.

Table 14: Garnish Mounted Operational Cycle Temperature Profile.

Cycles	Temperature
Run 7 000 cycles	23 ± 5°C
Run 1 000 cycles	85 ± 5°C
Run 1 000 cycles	-30 ± 5°C
Run 1 000 cycles	40 ± 5°C and 95% relative humidity

Note: Cycle at a maximum of ten (10) cycles per minute. Measure efforts after each life. Repeat profile.

3.2.4 Serviceability. The following paragraphs define the constraints and requirements associated with serviceability of the Interior Lighting subsystem. Serviceability is the ease and cost of performing the maintenance, diagnosis, and repair operations necessary to preserve the original performance level of the vehicle throughout its useful lifecycle. The Interior Lighting Subsystem shall be independently serviceable in accordance with program specific guidelines. Additional, all interior lamps shall be independently serviceable without removal of the Interior Trims.

3.2.4.1 Repairs. Requirements associated with service/repair procedures, e.g., components removal/re-installation, target times will be evaluated and negotiated with the responsible service engineer. Refer to SOR Appendix J, GMN10068 and Appendix J2 CG1188.

3.2.4.1.1 To aid in serviceability, the lamp design shall:

3.2.4.1.1.1 Utilize Fasteners that are easy to remove

3.2.4.1.1.2 Avoid heat staking

3.2.4.1.1.3 No bonding where service activities are involved

3.2.4.1.1.4 Bulbs should be accessible without tools to the customer

3.2.4.1.1.5 Trim mounted pointed lamps shall have lenses and bulbs that are easy to remove

3.2.4.1.1.6 An adequate length service loop (lead wire) should be provided to allow electrical disconnect with removing the lamps.

3.2.4.2 New Essential Tools. The Interior Lighting Subsystem shall be removable with existing tools.

Note: A tool categorization has been included in the Delta VTS. The interior lighting assembly

should not require special knowledge for removal and reinstallation. The design shall not require the use of any new or special tool.

3.2.4.3 Maintenance. The lamps shall not require any maintenance during the life of the vehicle, but provide service access if panels obstruct access to maintainable components.

3.2.4.3.1 Performance of Maintenance. The Interior Lighting Subsystem maintenance requirements are:

3.2.4.3.1.1 The subsystem shall not require any tool for service other than those listed in the Household Tools paragraph of the program-specific VTS/SOR and appendices.

3.2.4.3.1.2. The subsystem shall require no service other than periodic replacement of light bulbs.

3.2.4.3.1.3 All bulb replacement shall be capable of being accomplished by a vehicle owner/operator as defined in the program-specific VTS, SOR and appendices. Gas discharge versions excluded.

3.2.4.3.1.4 The time required to access and replace any light bulb shall be ≤ 10 minutes.

3.2.4.3.1.5 Lamps shall be serviceable separately from any trim or electronic component(s).

3.2.4.3.1.6 The lamps/lenses shall be capable of being cleaned with any common cleaning agents as defined in GM9126P.

3.2.4.4 Repair.

3.2.4.4.1 System Diagnosis.

3.2.4.4.1.1 All subsystem components shall provide an "envelope of clearance" that allows a 95% percentile male hand appropriate service tool, and/or equipment clearance to gain effective working access.

3.2.4.4.1.2 Harness connectors shall be oriented for access and removal without the removal of any additional parts beyond what are required for accessing the harness connector's attached component.

3.2.4.4.2 System Repair.

3.2.4.4.2.1 All electrical components shall incorporate features preventing electrostatic discharge damage to electronic devices during normal handling of parts.

3.2.4.4.2.2 Accidental grounding during service procedures shall not cause malfunctions or cause damage to the part.

3.2.4.4.2.3 All subsystem components, shall provide an "envelope of clearance" that allows a 95 percentile male hand appropriate service tool and/or equipment clearance to gain effective working access.

3.2.4.4.2.4 Harness connectors shall be oriented for access and removal without the removal of any additional parts beyond what are required for accessing the harness connector's attached component.

3.2.4.4.3 Performance of Repair. Repair operations are expected to be performed by either the vehicle owner or a technician to return the Interior Lighting Subsystem to a proper operating condition. The associated requirements are:

3.2.4.4.3.1 All repair operations shall be obvious to the operator and easy to ac-accomplish without the use of special tools.

3.2.4.4.3.2 The time required to access and replace individual subsystem components shall be < 10 minutes unless otherwise specified in VTS, SOR and appendices.

3.2.4.4.3.3 Risk of injury shall be prevented by appropriate warning labels for electrical hazards and high temperature areas, and the elimination of all sharp edges.

3.2.4.4.3.4 Service/repair procedures shall be completed without damage or degradation to part, or related parts/components.

3.2.4.4.3.5 Serviceable subassemblies and components shall follow the requirements of North American Simultaneous Parts Release Process. Service labor times for diagnosis and removal and reinstallation procedures shall be kept to a minimum to reduce the cost of service, vehicle ownership and Warranty cost.

3.2.4.4.3.6 The performance of repair tasks shall not subject the individual performing the task to risk of injury due to any physical characteristic or thermal characteristics of the interior lamp subsystem.

3.2.4.4.4 Fasteners. All fasteners are to be selected from the NAO Fastening Catalog. Those not on the fastening catalog requires the approval of GM Fastening Engineering. The fastener shall also meet the following requirements:

3.2.4.4.4.1. The attachment process shall not adversely affect the corrosion protection and structural integrity of the interfacing components.

3.2.4.4.4.2. The production process, e.g., positioning of spot weld, surface treatment, corrosion protection, etc. must not negatively affect the function of the joint.

3.2.4.4.4.3. Attaching clips installation loads shall be less than 50 N.

3.2.4.4.4.4. Attaching clips shall have extraction load greater than 100 N.

3.2.4.4.4.5 The joint must have full function between minimum and maximum assembly (dynamic) torques. The joint must not deform permanently at maximum assembly torque. Due to loose fasteners, the joint must not require re-tightening over the lifetime of the vehicle. The minimum static torque must be achieved after assembly.

3.2.4.4.4.6. No vehicles are to use tapped or extruded holes.

3.2.4.5 Collision Repair. Reduce the cost of insurance through lower repair costs by packaging costly items in the least vulnerable areas. Those items that are in the highly vulnerable areas should be cost-effective to repair or replace.

3.2.4.5.1 Service Parts.

3.2.4.5.1.1 Parts not serviceable should be clearly noted as such.

3.2.4.5.1.2 Repaired parts must meet original/new part quality standards.

3.2.4.5.1.3 Service parts must meet original/new part quality standards.

3.2.4.5.1.4 The design of production parts for service purposes must be comprehend.

3.2.5 User-Subsystem Interface. The Interior Lighting components and interfaces shall comply with the Human Factors Design Objectives (HFDO). Refer to Labels Section V for General Labeling HFDOs and Controls Section U for General Hand Controls HFDOs. HFDOs can be accessed on the following GM intranet website http://gmna1.gm.com/vp/vapi/hhf/hfdo/.

3.3 Design and Construction. Design and construction of the Interior Lighting Subsystem is to be constrained as described in the following paragraphs.

3.3.1 Material, Processes, and Parts Selection Guidelines. Subparagraphs of 3.3.1 identify constraints, standards, and guidelines that affect the selection of materials, processes, and parts to be used in the subsystem and its manufacture and assembly.

3.3.1.1 Design of Recyclable/Recoverable Systems. The Interior Lighting Subsystem shall comply with GMW3116, Recyclability/Recoverability Guidelines. No calculations according to chapter 4 in GMW3116 are required. Recyclability shall be demonstrated by utilizing the part recyclability/recoverability report form in GMW3116. Contact the Design for Environment organization of Materials Engineering for assistance.

3.3.1.2 Restricted and Reportable Substances. The Interior Lighting Subsystem shall comply with GMW3059, Restricted and Reportable Substances for Parts.

3.3.1.3 Use of Recycled Materials. Refer to GMW3116, Recyclability/Recoverability. Guidelines for a list of approved recycled/recoverable materials. For GMNA, contact the Design for Environment Group for further guidance. For GME, refer to Use of Recycled Materials file on GMSupplyPower.com or contact GME-ITDC Environmental Strategy and Regulations.

3.3.2 Design Guidelines and Constraints. Interior Lighting Subsystem design guidelines and/or constraints are given in the following paragraphs.

3.3.2.1 Interior Fittings. All exposed radii that may contact the head form shall conform to FMVSS 201 and ECE R21.

3.3.2.2 Fail-Safe Design. Fail-safe design requirements are:

3.3.2.2.1 A Failure Mode, Effect, and Criticality Analysis (FMECA) shall be performed to determine concept modifications needed to prevent functional problems for the following conditions:

3.3.2.2.1.1 Short to B+

3.3.2.2.1.2 Short to Ground

3.3.2.2.1.3 Open Circuit

Note to author: A paper study is acceptable unless the outcome is unknown, in which case an actual test on hardware must be performed.

3.3.2.2.2 The FMECA shall consist of two studies, Internal Influence and External Influence:

3.3.2.2.2.1 The Internal Influence study shall consist of examining each pin connection of each component of the Interior Lighting Subsystem, under the conditions described above, and determining the effect on the input and output terminals of the vehicle harness interface connectors. Design changes are necessary for an undesired outcome as determined by GM Engineering, Reliability, and/or Service groups.

3.3.2.2.2.2 The External Influence study shall consist of applying the above conditions to the input and output terminals of the vehicle harness interface connectors and determining the effects on components internal to the Interior Lighting Subsystem equipment. Design changes are necessary for any undesired outcome as determined by Platform/Engineering centers, Reliability, and/or Service groups.

3.3.2.2.3 All assembly interfaces shall be exercised through a Design for Assembly analysis and designed so that only correct assembly is possible.

3.3.2.3 Connectors. All connection systems, wire harness in-line applications, or new device applications (control units, switches, sensors, motors etc.) to be utilized in the corporate courtesy and reading lamp must use of wiring connectors from the GM Recommended Connector Catalog. The GM Recommended Connector Catalog is maintained exclusively by the Global Electrical Engineering – Product and Process Engineering Center (PPEC). A selection from the catalog will require approval per the connector selection process and the supplier must comply with the following:

3.3.2.3.1 All connectors being proposed by component suppliers and wiring suppliers must be approved in advance of the device development activity by the Global Connector Group within the Global Electrical Engineering PPEC.

3.3.2.3.2 During the component/subsystem sourcing (control units, switches, sensors, motors, etc.) the responsible group must include the wire harness connector impact in the decision process using the CONNECTOR REQUEST FORM.

3.3.2.3.3 The interior lighting subsystem electrical interface: shall comply with, and be validated to 3.3.2.3.3.1 to 3.3.2.3.3.4.

3.3.2.3.3.1 GMW3191, Electrical Connectors.

3.3.2.3.3.2 GMW14028, Connector Design Guidelines.

3.3.2.3.3.3 SAE/USCAR-21, Revision One (1), Performance Specification for Cable-to-Terminal Electrical Crimps.

3.3.2.3.3.4 SAE/USCAR-25, Electrical Connector Assembly Ergonomic Design Criteria.

3.3.2.3.4 The interior lighting subsystem electrical connection system: shall be designed and validated to 3.3.2.3.4.1 to 3.3.2.3.4.3

3.3.2.3.4.1 GMW 3191 Vibration Class One (1)

3.3.2.3.4.2 GMW 3191 Temperature Class One (1) and Three (3)

3.3.2.3.4.3 GMW 3191 Sealing Class Three (3) (Unsealed)

3.3.2.3.5 The supplier shall follow the design interfaces for connectors defined within Appendix B.

3.3.2.4 The corporate courtesy and reading lamp shall also comply with the following electrical interface requirements:

3.3.2.4.1 The courtesy and reading lamp shall incorporate an unsealed integral male connector utilizing GM approved 1.50 mm male terminals. Furthermore, GM reserves the right to revise this electrical interface any time prior to tooling design freeze.

3.3.2.4.2 The courtesy and reading lamp shall have a terminal to receive a positive battery feed (with battery run-down protection) from the vehicle's Power and Signal Distribution System for the courtesy lamp ON position.

3.3.2.4.3 The courtesy and reading lamp shall have a terminal to receive a separate power feed (with PWM capability) from the vehicle's Power and Signal Distribution System to perform theater lighting (dimming) in the courtesy lamp DOOR position.

3.3.2.4.4 The courtesy and reading lamp shall have a terminal to provide a ground for power return.

3.3.2.4.5 The courtesy and reading lamp off position should be an open circuit.

3.3.2.5 The angle between view direction and light source should exceed 45 degrees.

3.3.3 Identification and Marking. The identification and marking of major components of the interior lighting subsystem shall comply with the following:

3.3.3.1 All major components of the subsystem shall be marked with 3.3.3.1.1 to 3.3.3.1.4.

3.3.3.1.1 GM logo

3.3.3.1.2 GM part number (located next to the GM logo)

3.3.3.1.3 Date code

3.3.3.1.4 Material identification per 3.3.3.7.

Note: There shall be no additional markings on the part.

3.3.3.2 Lamp identification and markings shall be embossed, de-bossed, or applied using a separate label and located on a lamp surface not visible to the customer in the installed position.

3.3.3.3 Markings must meet the design requirements defined in GMN11194 Label Design Criteria General Specification. Markings must comply with any regulations associated with them. Factors identified in regulations may include location, font size, text and graphic areas, and color.

3.3.3.4 Markings must be visible to assembly and service personnel. Markings must also be in close proximity to the component/system they describe. All markings shall be legible throughout the life of the parts, defined in paragraph 3.2.3.1 Target Life.

3.3.3.5 If a label is used, then label material specifications must be selected in accordance with GM501M – Automotive Label Material Specification Selector. Labels shall also complete

validation testing. Testing must be done on production intent labels located on production intent components, installed using the production process.

3.3.3.6 Major subsystem components which are sensitive to electrostatic discharge shall have an electrostatic discharge (EDS) sensitive labels which conforms to the direction of GM 9107P.

3.3.3.7 Marking of polymeric parts shall comply with GMW 3116, Recyclability/Recoverability Guidelines. For the labeling and identification of vehicle plastic components and materials having a weight of more than 100 g, the following standards apply:

3.3.3.7.1 ISO 1043-1 Plastics – Symbols and abbreviated terms – Part 1: Basic polymers and their special characteristics

3.3.3.7.2 ISO 1043-2 Plastics – Symbols and abbreviated terms – Part 2: Fillers and reinforcing materials

3.3.3.7.3 ISO 11469 Plastics – Generic identification and marking of plastic products

3.3.3.8 Marking of rubber parts or elastomer components and materials having a weight of more than 200 grams, the following standards apply:

3.3.3.8.1 ISO 1629 Rubbers and Lattices – Nomenclature

3.4 Documentation. The following documents/procedures should be prepared/executed in whole or in part, for the Interior Lighting Subsystem:

3.4.1 FMVSS and export compliance documentation

3.4.2 Master layout drawings

3.4.3 Detail drawings with geometric dimensions and tolerances (GD&T)

3.4.4 Variation Simulation Modeling (VSM)

3.4.5 Design Failure Mode and Effects Analysis (DFMEA)

3.4.6 Process Failure Mode and Effects Analysis (PFMEA)

3.4.7 Product Assembly Documents (PAD)

3.4.8 Owner's Manual

3.4.9 Service Manual

3.4.10 Production Part Approval Process (PPAP)

3.4.11 Design for Manufacturing/Assembly (DFMA)

3.4.12 GM Blue Book

3.4.13 Motor Vehicle Dimensions Procedure Manual

3.4.14 Interior Lighting Subsystem Technical Specification provided by Platform and Engineering Centers

3.4.15 GP-3 Validation Documentation supplied by supplier(s) in accordance with General Motors Target for Excellence (GM1644) standard

3.4.16 Component Technical Specification

3.5 Support of Subsystem After Sale. None noted, other than stipulated Corporate warranty.

3.6 Subsystem Operator Training. Subsystem equipment operation shall be documented in the Owner's Manual.

4 Validation

The following paragraphs of this section identify the validations by which it must be shown that the Subsystem/Component satisfies the requirements given in this document. Paragraph 4.2 relates the subsystem requirements to the procedures to be used in the validation process. Subparagraphs of paragraph 4.3 provide additions/clarifications of existing procedures that are needed to fully validate the subsystem or give brief descriptions of necessary procedures where none presently exist. Note that Section 4 is not the validation plan, but does provide technical input to the validation plan.

4.1 General. The validation specified herein is to be conducted using one (1) or more of the following methods.

4.1.1 Test. Verifying that a requirement is met by thoroughly .exercising the item being validated under specified conditions in accordance with a test procedure; collecting quantitative data via test instrumentation; reducing and analyzing the collected data; and comparing the result to the specified requirement.

4.1.2 Analysis. Verifying that a requirement is met by technical or mathematical evaluation of equations, algorithms, recorded data, charts, graphs, circuit diagrams, and representative data; and/or simulation of the item being validated using a mathematical representation, e.g., mathematical models, algorithms, or equations.

4.1.3 Inspection. Verifying that a requirement is met by the physical examination of the item being validated, and comparing the observed physical characteristics with the requirement and/or drawings.

4.1.4 Demonstration. Verifying that a requirement is met by exercising the item being validated, under specified conditions in accordance with a procedure, observing the results, and comparing the results to the specified requirements. The

collection of test data via test instrumentation is normally not required.

4.1.5 All validation is to be performed on designs with minimum subsystem levels of "production intent".

Note: This defines the minimum level of product readiness that must be achieved prior to component validation.

4.1.6 The validations specified in paragraph 4.2 are to be conducted to confirm that the Interior Lighting Subsystem meets the requirements of this specification. The validation is to be performed on six production intent Interior Lighting Subsystems.

4.2 Validation Cross Reference Index. The validation cross reference index (VCRI) relates the Subsystem/Component requirements to their associated validation procedures. The VCRI identifies the applicable validation procedures, the method of validation (test, analysis, demonstration, or inspection) to be performed, the level (vehicle, subsystem, or component) at which the validation is to be preformed, and whether General Motors or the (Subsystem/Component) supplier is responsible for the validation. Refer to SOR Appendix C3 for the program specific VCRI.

4.3 Supporting Paragraphs. The following paragraphs define/describe modifications to existing procedures and/or additional procedures that are needed to be able to adequately verify that the Subsystem/Component meets its complete set of requirements.

4.3.1 Interior Lighting Functional Performance Tests. Validation shall be conducted to confirm that the Interior Lighting Subsystem complies with the functional performance requirements specified in paragraph 3.2.1.

5 Provisions for Shipping

5.1 Shipping Requirements. Refer to SOR Appendix H for shipping requirements.

6 Notes

6.1 Glossary

The use of "Shall" in this document denotes a binding provision that must be met. "Should" denotes a preference or desired conformance which if not met must be documented and disclosed to General Motors. Unless otherwise noted, all requirements apply over the conditions and target life as described herein. The Interior Center and/or the Responsible GM Platform(s) will be the final arbiter of performance if the requirements stated herein are not objectively defined.

6.2 Acronyms, Abbreviations, and Symbols.

CMVSS	Canadian Motor Vehicle Safety Standards
CRI	Color Rendering Index
DFMEA	Design Failure Mode Effects Analysis
DTS	Dimensional Technical Specification
EDS	Electrostatic Discharge
EMC	Electromagnetic Compatibility
FMEA	Failure Mode and Effects Analysis
FMECA	Failure Mode, Effect, and Criticality Analysis
FMVSS	Federal Motor Vehicle Safety Standards (USA)
FR	Field Replacement
GD&T	Geometric Dimensions and Tolerances
GMUTS	GM Uniform Test Specification
H Point	Hip Point Reference
HFDO	Human Factors Design Objectives
IPTV	Incidents Per Thousand Vehicles
ITDC	International Technical Development Center
IVER	Integration Vehicle Engineering Release
Lux	Unit of illumination or illuminance, 1 Lux = 1 lm/m^2
MCBF	Mean Cycles Between Failures
N	Newtons
NAO	North American Operations
PAD	Product Assembly Documents
PFMEA	Process Failure Mode and Effects Analysis
PPAP	Production Part Approval Process
PPEC	Product and Process Engineering Center
PWM	Pulse Width Modulation
REP	Reliability Evaluation Points
RMS	Root Mean Squared
SAE	Society of Automotive Engineers
SgRP	Recommended Seating Position (H-Point)
SSLT	Subsystem Leadership Team
SSTS	Subsystem Technical Specification
SWR	Standing Wave Ratio
VCRI	Validation Cross Reference Index

VPPS	Vehicle Partitioning & Product Structure
VSM	Variation Simulation Modeling
VTS	Vehicle Technical Specification

7 Additional Paragraphs

7.1 All parts or systems supplied to this standard must comply with the requirements of GMW3059, **Restricted and Reportable Substances for Parts.**

8 Coding System

This standard shall be referenced in other documents, drawings, etc. as follows:

GMW14118

9 Release and Revisions

9.1 Release. This standard originated in May 2005, replacing part of CG959. It was first approved by Global Interior Lighting SSLT in February 2006. It was first published in April 2007.

Appendix A

Table A1: Roof Trim Vibration Input Frequencies and Amplitudes

40.03.03 Roof Trim
(e.g., sunvisor, courtesy, reading, and cargo lamps), Trunk Trim, and Garnish Trim

Vertical Acceleration	
Frequency (Hertz)	Acceleration $((m/s^2)^2/Hz)$
8	0.16599
11	1.04536
21	0.11826
34	0.18290
41	0.22629
58	0.15900
73	0.04505
87	0.01344
100	0.00100
m/s^2 RMS	3.69

40.03.03 Roof Trim
(e.g., sunvisor, courtesy, reading, and cargo lamps), Trunk Trim and Garnish Trim

Fore-aft Acceleration	
Frequency (Hertz)	Acceleration $((m/s^2)^2/Hz)$
8	0.08333
11	0.87711
14	0.35816
18	0.36575
26	0.04060
36	0.08272
57	0.04109
73	0.01320
100	0.00014
m/s^2 RMS	2.77

40.03.03 Roof Trim
(e.g., sunvisor, courtesy, reading, and cargo lamps), Trunk Trim, and Garnish Trim

Lateral Acceleration	
Frequency (Hertz)	Acceleration $((m/s^2)^2/Hz)$
8	0.25561
10	0.51494
12	0.58321
23	0.13719
38	0.06653
56	0.03428
73	0.01906
100	0.00018
m/s^2 RMS	2.80

Table A2: Instrument Panel Vibration Input Frequencies and Amplitudes

40.01.02 IP
(e.g., glovebox and footwell lamps)

Vertical Acceleration	
Frequency (Hertz)	Acceleration $((m/s^2)^2/Hz)$
8	0.39505
12	2.40196
19	0.39267
38	0.08028
61	0.03877
88	0.00309
100	0.00030
m/s^2 RMS	4.13

40.01.02 IP
(e.g., glovebox and footwell lamps)

Fore-aft Acceleration	
Frequency (Hertz)	Acceleration $((m/s^2)^2/Hz)$
8	0.10690
11	0.80990
12	0.91809
14	0.26051
19	0.30001
24	0.15013
35	0.05013
57	0.03106
85	0.00352
100	0.00035
m/s^2 RMS	2.76

40.01.02 IP
(e.g., glovebox and footwell lamps)

Lateral Acceleration	
Frequency (Hertz)	Acceleration $((m/s^2)^2/Hz)$
8	0.34530
10	1.09843
12	1.30177
15	0.39274
39	0.07968
73	0.01613
100	0.00031
m/s^2 RMS	3.39

Appendix A continued:

Table A3: Floor Console Vibration Input Frequencies and Amplitudes

40.01.03 Floor Console
(e.g., cupholder and console bin lamps)

Vertical Acceleration	
Frequency (Hertz)	Acceleration $((m/s^2)^2/Hz)$
8	0.23311
11	2.04504
14	0.51133
32	0.15260
61	0.04613
69	0.08392
100	0.00128
m/s^2 RMS	3.77

40.01.03 Floor Console
(e.g., cupholder and console bin lamps)

Fore-aft Acceleration	
Frequency (Hertz)	Acceleration $((m/s^2)^2/Hz)$
8	0.03743
10	0.09669
12	0.48398
19	0.30962
23	0.10213
44	0.06679
69	0.04810
100	0.00392
m/s^2 RMS	2.77

40.01.03 Floor Console
(e.g., cupholder and console bin lamps)

Lateral Acceleration	
Frequency (Hertz)	Acceleration $((m/s^2)^2/Hz)$
8	0.13967
10	0.50487
12	0.84358
16	0.24670
35	0.45706
57	0.69721
71	0.08412
88	0.06922
100	0.00588
m/s^2 RMS	5.36

Table A4: Front Door Trim Vibration Input Frequencies and Amplitudes

40.03.02 Front Door Trim
(e.g., door entry/exit lamp)

Vertical Acceleration	
Frequency (Hertz)	Acceleration $((m/s^2)^2/Hz)$
8	0.57463
10	2.30976
12	2.48289
19	0.30401
23	0.51005
34	0.12915
65	0.02213
100	0.00289
m/s^2 RMS	4.54

40.03.02 Front Door Trim
(e.g., door entry/exit lamp)

Fore-aft Acceleration	
Frequency (Hertz)	Acceleration $((m/s^2)^2/Hz)$
8	0.30035
12	1.37810
13	0.56837
25	0.25820
29	0.04687
36	0.16139
56	0.01905
76	0.00847
100	0.00447
m/s^2 RMS	3.35

40.03.02 Front Door Trim
(e.g., door entry/exit lamp)

Lateral Acceleration	
Frequency (Hertz)	Acceleration $((m/s^2)^2/Hz)$
8	0.32951
9	0.33846
11	1.48204
14	0.29140
20	0.21749
42	0.13483
55	0.03734
100	0.00933
m/s^2 RMS	3.33

Appendix A continued:

Table A5: Rear Door Trim Vibration Input Frequencies and Amplitudes

40.03.02 Rear Door Trim
(e.g., door entry/exit lamp)

Vertical Acceleration	
Frequency (Hertz)	Acceleration $((m/s^2)^2/Hz)$
8	0.67596
11	2.26444
17	0.41804
23	0.41382
26	0.07603
52	0.05168
65	0.03272
78	0.00668
90	0.00374
100	0.00040
m/s^2 RMS	3.97

40.03.02 Rear Door Trim
(e.g., door entry/exit lamp)

Fore-aft Acceleration	
Frequency (Hertz)	Acceleration $((m/s^2)^2/Hz)$
8	0.18092
10	0.34597
11	1.03646
15	0.16177
29	0.02887
43	0.02310
47	0.05774
58	0.00566
70	0.00962
100	0.00006
m/s^2 RMS	2.20

40.03.02 Rear Door Trim
(e.g., door entry/exit lamp)

Lateral Acceleration	
Frequency (Hertz)	Acceleration $((m/s^2)^2/Hz)$
8	0.06862
12	0.53757
17	0.06929
38	0.03580
42	0.02695
47	0.11038
51	0.02310
75	0.00776
100	0.00096
m/s^2 RMS	2.03

Table A6: Rear Door Trim Vibration Input Frequencies and Amplitudes

Seats

Vertical Acceleration	
Frequency (Hertz)	Acceleration $((m/s^2)^2/Hz)$
8	0.38432
11	2.01611
19	0.27597
22	0.33600
39	0.07441
63	0.03255
98	0.00576
100	0.00157
m/s^2 RMS	3.85

Seats

Fore-aft Acceleration	
Frequency (Hertz)	Acceleration $((m/s^2)^2/Hz)$
8	0.10232
12	0.54470
14	0.25538
20	0.10970
24	0.15534
30	0.07909
47	0.03761
63	0.01279
84	0.00225
100	0.00049
m/s^2 RMS	2.35

Seats

Lateral Acceleration	
Frequency (Hertz)	Acceleration $((m/s^2)^2/Hz)$
8	0.14385
12	1.14839
20	0.04848
24	0.11061
30	0.04140
45	0.04036
69	0.01335
98	0.00179
100	0.00074
m/s^2 RMS	2.57

Appendix A continued:

Table A7: Lift Gate Trim Vibration Input Frequencies and Amplitudes

40.03.01 Liftgate
(e.g.,liftgate mounted cargo lamp)

Vertical Acceleration	
Frequency (Hertz)	Acceleration $((m/s^2)^2/Hz)$
8	1.37040
10	1.32613
11	4.35180
16	0.18429
62	0.01424
65	0.02983
100	0.00014
m/s^2 RMS	3.74

40.03.01 Liftgate
(e.g.,liftgate mounted cargo lamp)

Fore-aft Acceleration	
Frequency (Hertz)	Acceleration $((m/s^2)^2/Hz)$
8	0.19199
10	0.32027
11	2.00171
15	0.06544
18	0.16745
21	0.04812
71	0.00454
73	0.00243
100	0.00012
m/s^2 RMS	2.23

40.03.01 Liftgate
(e.g., liftgate mounted cargo lamp)

Lateral Acceleration	
Frequency (Hertz)	Acceleration $((m/s^2)^2/Hz)$
8	0.42142
9	0.25454
12	3.19408
18	0.08353
32	0.04542
51	0.00472
69	0.01203
100	0.00003
m/s^2 RMS	3.17

Appendix B

Table B1: Duty Cycle Parameters

Component	One Customer Usage Test (cycles)
Overhead Courtesy Lamp or Combined Courtesy and Reading Lamp	10 000
Reading Lamp	10 000
Vanity Light	5 000
Glovebox Light	10 000
Footwell light	10 000
Trunk/Cargo Light	50 000
Console Bin Light	10 000
Ambient Light	20 000
Underhood Light	3 000

Appendix C

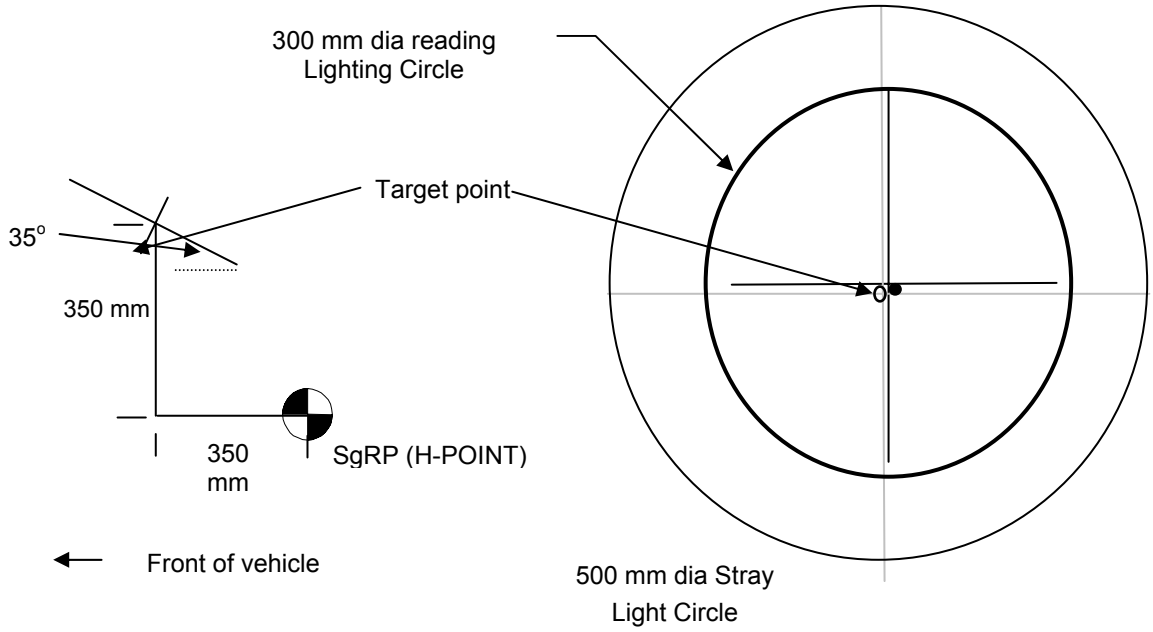


Figure C1: Reading Lamp Target Area

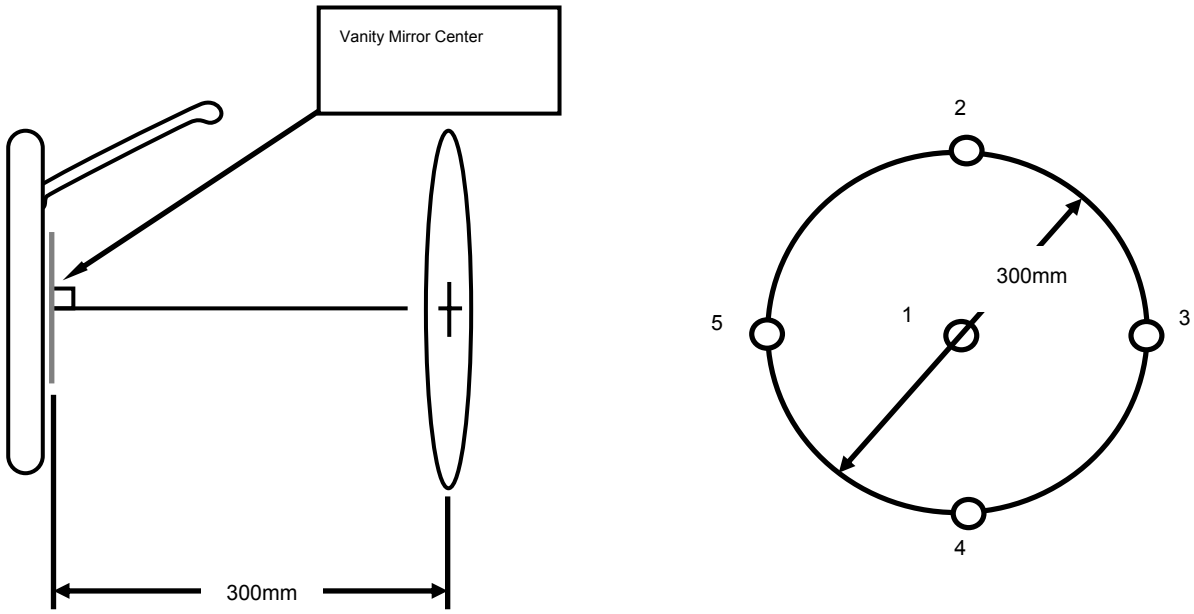
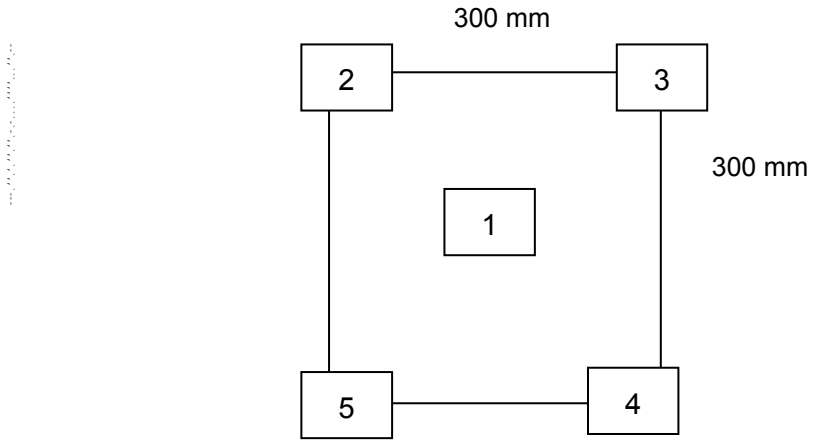


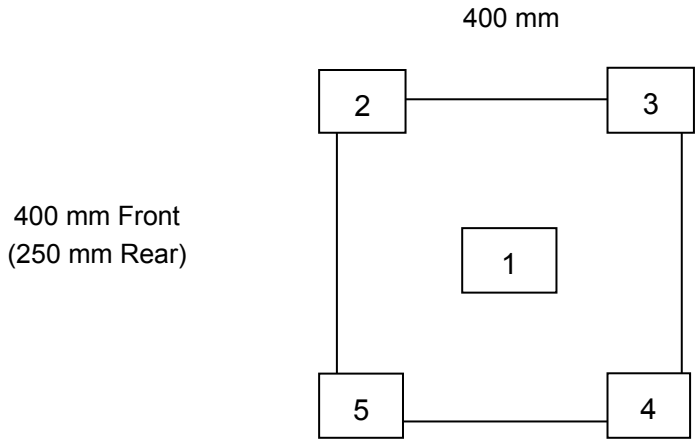
Figure C2: Vanity Lamp Target Area

Appendix C continued:



Note: Target area centered on the seat cushion

Figure C3: Courtesy Lamp Target Area



Note: Target area centered within the footwell.

Figure C4: Footwell Lamp Target Area

Appendix C continued:

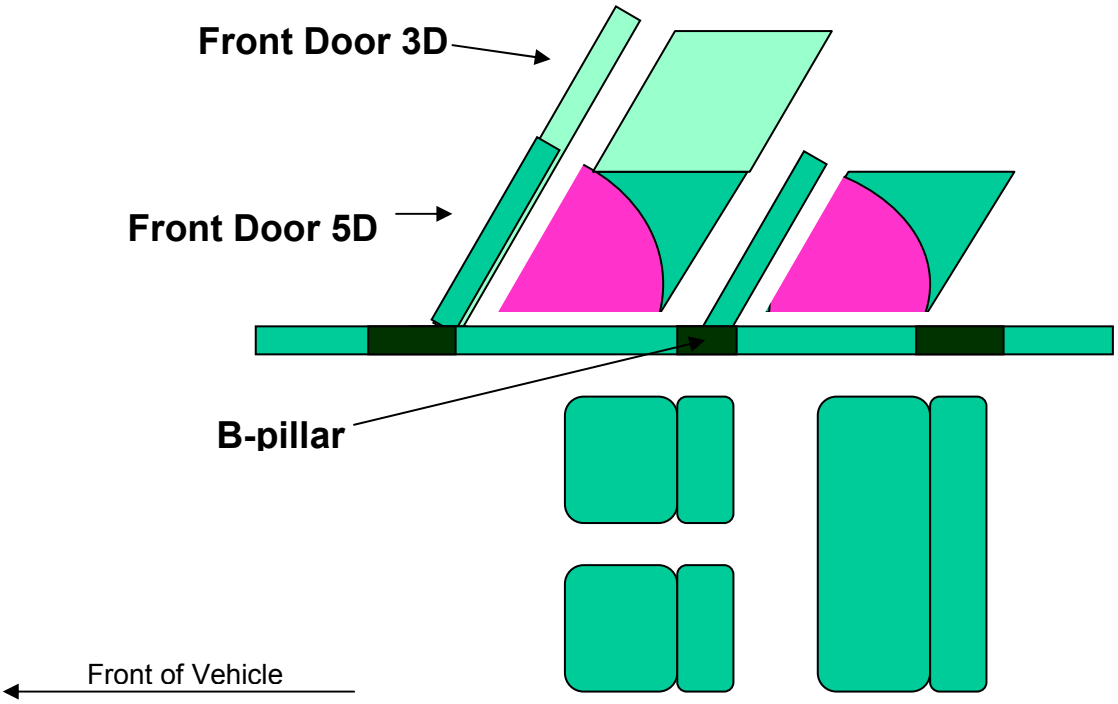
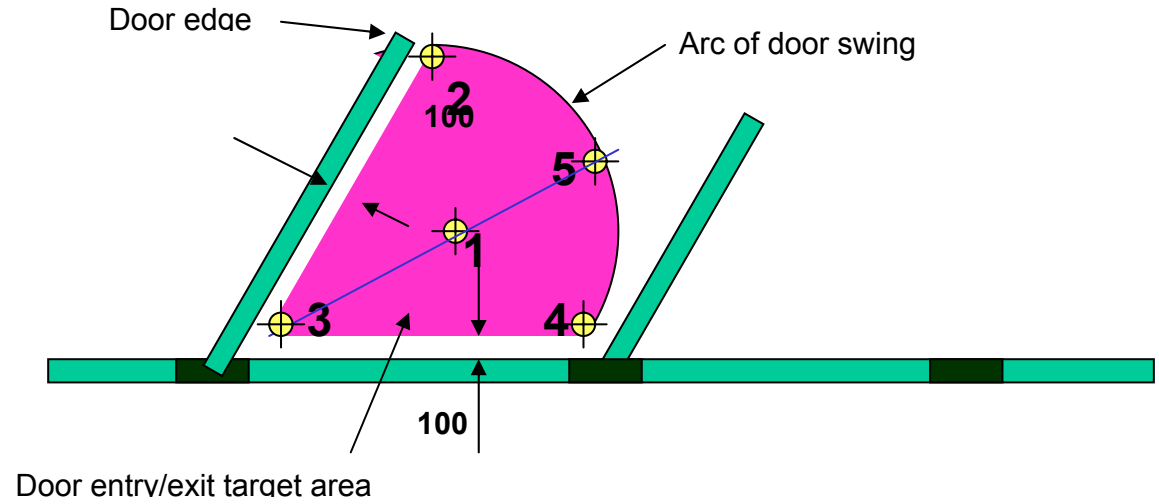
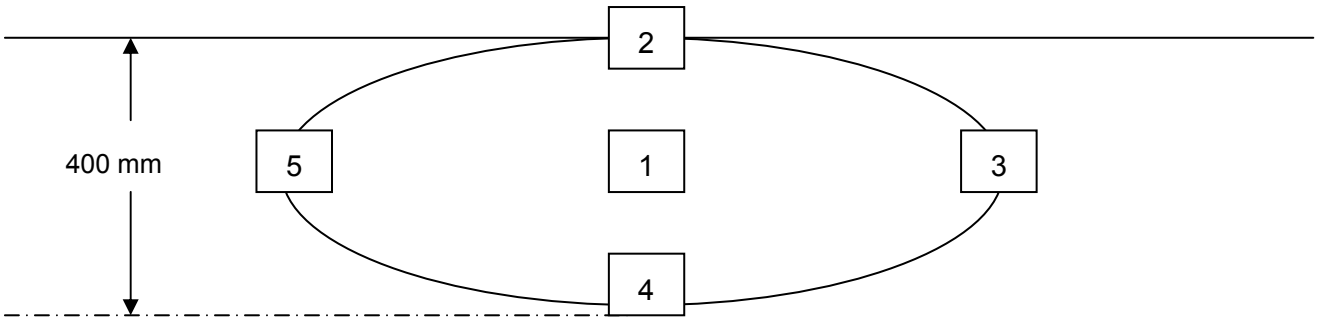


Figure C5: Front and Rear Door Vehicle Plan View



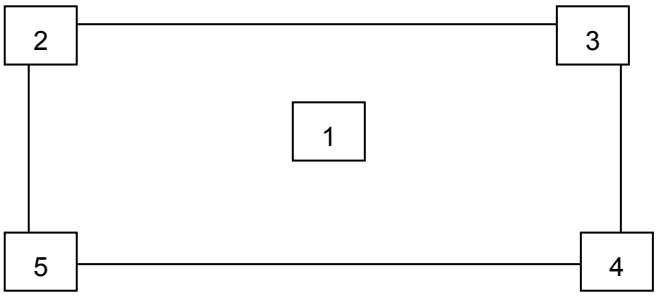
Note: Detailed Target Area

Figure C6: Door Entry/Exit Lamp Target Area (Figure C5 and C6).



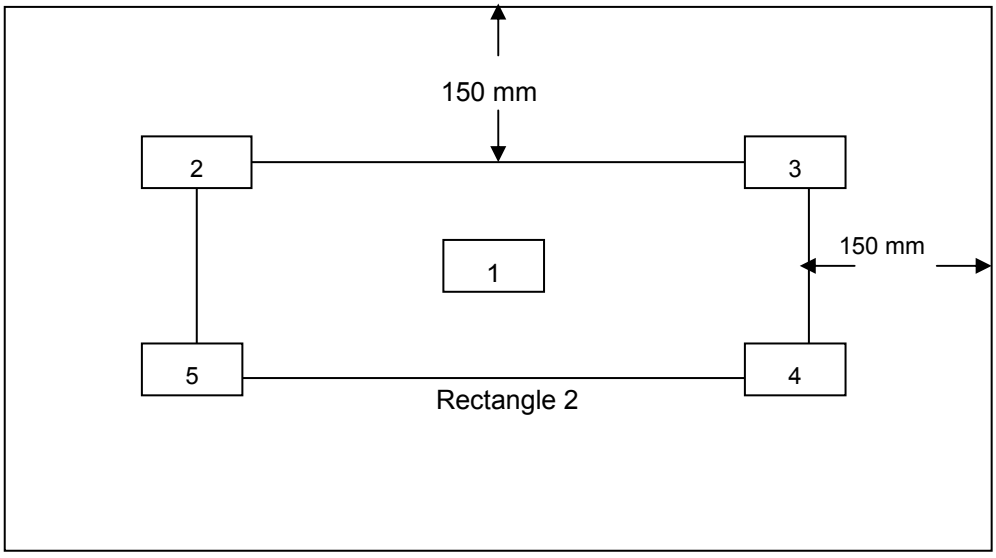
Note: Bumper or an allowance distance from the bumper

Figure C7: Rear Puddle Target Area



Note: Glovebox “floor” of a stationary bin or inside floor of a rotating bin

Figure C8: Glovebox Lamp Target Area



Note: Rectangle 1 perimeter of Trunk or cargo floor

Figure C9: Trunk/Cargo Lamp Target Area

Appendix D

Table D1: Assignment of Subsystem Requirements to Interior Lighting Components

All paragraphs contained within this specification are applicable to any Interior Lighting Subsystem with the exception of paragraphs 3.1.3.1, 3.1.3.3, 3.1.3.9 – 3.1.3.9.2, 3.2.1.2.1 – 3.2.1.2.3.2, and 3.2.1.17.

Requirement Paragraph	Requirement Description	Courtesy Lighting	Task Lighting	Ambient Lighting
3.1.3.1	Engine Compartment Temperature		Underhood Lamps	
3.1.3.3	Ozone	Rubber Materials Only		
3.1.3.9 – 3.1.3.9.2	Weather Exposure		Underhood Lamps	
3.2.1.2.1	Courtesy Lighting	X		
3.2.1.2.1.1 – 3.2.1.2.1.1.2	Overhead Courtesy Lamp	X		
3.2.1.2.1.2- 3.2.1.2.1.2.2	Footwell Lighting	X		
3.2.1.2.1.3 – 3.2.1.2.1.3.2	Door Entry/Exit Lighting	X		
3.2.1.2.2	Task Lighting		X	
3.2.1.2.2.1 – 3.2.1.2.2.1.2	Reading Lamps		X	
3.2.1.2.2.2 – 3.2.1.2.2.2.2	Vanity Lighting		X	
3.2.1.2.2.3 – 3.2.1.2.2.3.2	Storage Compartment Lighting		X	
3.2.1.2.2.4 – 3.2.1.2.2.4.2	Trunk Lighting		X	
3.2.1.2.2.5 – 3.2.1.2.2.5.2	Cargo Lighting		X	
3.2.1.2.2.6 – 3.2.1.2.2.6.2	Rear Puddle Lighting		X	
3.2.1.2.2.7 – 3.2.1.2.2.7.1	Underhood Lighting		X	
3.2.1.2.3 – 3.2.1.2.3.2	Ambient Lighting			X
3.2.1.17	Thermal Shock in Water		Underhood Lamps and Lamps mounted outside door sill	